INERTIAL CONFINEMENT FUSION
Lawrence Livermore National Laboratory

Monthly Highlights

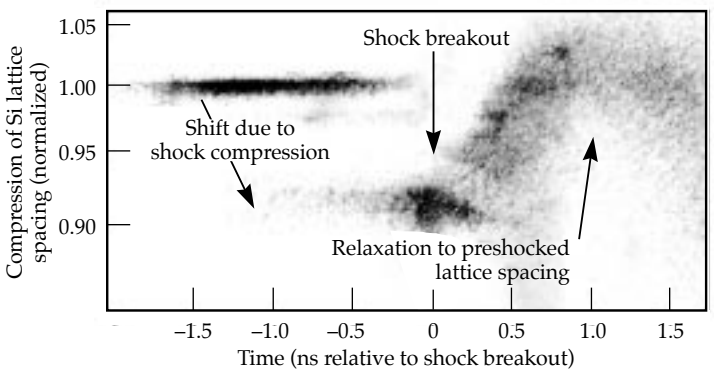
October 1997

UCRL-TB-128550-98-1

NIF Site Preparation on Schedule. The NIF construction and site preparation activities have continued on schedule for Project completion at the end of 2003. The excavation is 95% complete. Shown below is a photo of the target area excavation pit as seen from the future location of the NIF control room.

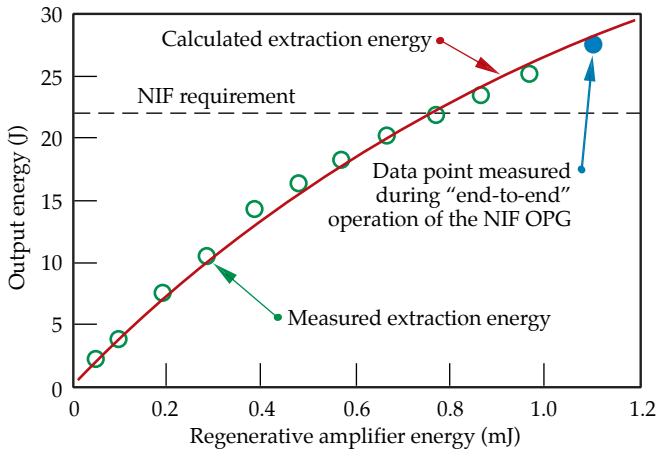
NIF target area excavation pit.

Dynamic Bragg Diffraction on Nova. Solid-state shock-compression experiments are being done on the Nova laser to study the transition from elastic to plastic deformation under shock compression. We are using Bragg diffraction to characterize the shock-wave profile inside shocked single-crystal samples. A low-temperature hohlraum drive shock-compresses the single-crystal silicon samples. Both time-integrated and time-resolved Bragg-diffracted x rays are then recorded to measure the compression of the 2D lattice spacing along the shock propagation direction (see figure below). We have observed compressions of up to 10% in one dimension in (111) silicon at 500-kbar drive pressure, and we are developing the capability to probe orthogonal lattice planes simultaneously. The Bragg diffraction work is being done under the Science (University) Use of Nova program in collaboration with scientists from the University of California at San Diego, the University of Oxford, and Los Alamos National Laboratory.



Time-resolved Bragg-diffracted x rays from shocked silicon.

Demonstration of NIF Optical Pulse System. We have successfully demonstrated operation of a NIF-like integrated optical pulse generation (OPG) system comprising an advanced master oscillator, a new regenerative amplifier, and a new 4-pass amplifier. These system components individually and in integrated operation now meet or exceed the NIF specifications for input to the main laser amplifier cavity in critical areas such as output energy, wavefront, contrast ratio, and square-pulse distortion. The master oscillator uses a fiber-based oscillator and NIF prototype fiber amplifiers. Its output of 180 pJ is delivered via a fiber-optic cable to the regenerative amplifier. We have achieved as much as 30 mJ of output from a new design of the "regen" amplifier with acceptable square-pulse distortion employing only a single diode-pumped head. The 4-pass amplifier has been designed using the 50-mm Nova-type rod amplifier. With this OPG system, we have produced integrated results at output energies well beyond the NIF requirement of 22 J with as small as 1 mJ from the regen amplifier (see graph below).



Demonstrated operation of the optical pulse generation system above the 22-J NIF requirement.

For comments about content of the *Monthly Highlights*, contact Don Correll (510)422-6784.
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Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.